

# The structure of humans: assuring locomotion, verticality and protection by the S...

[Health & Medicine](#)



## **Skeleton**

### **Please see labelled diagram attached**

Examples of long bones are the femur, ulna, tibia, metacarpals and humerus. They provide structure, mobility, strength and they are hard and dense. The long, slightly curved shaft and two epiphyses which are wider than the shaft provide the bone ability to carry out its functions. The shaft is made up of compact bone which surrounds a central medullary cavity which makes it incredibly strong and dense. The ability for long bones to act as levers allows muscles to work to their full potential, allowing for strength to be applied when lifting heavy objects. Blood cells that are produced in the body rely on the bones yellow and red bone marrow production to continue being produced. They are vital for skeletal mobility and are subjected to most of the load during activity. (Study. com, 2017)

### **Functions of the long bone:**

#### **Structure:**

They host vital organs and provide the shape for the body.

#### **Locomotion:**

The main qualities of bones are rigidity and strength, however using the kinematic skeletal system that uses muscles to control bone orientations and positions, movement is possible. They act as levers and transmit loads.

#### **Cell formation:**

The red marrow in the bone is a loose connective tissue containing hemocytoblasts/blood cell precursor cells and cells being made.

Inorganic salt regulation and storage of potassium, phosphate, calcium and sodium.

Bone structure has an overall microscopic composition and macroscopic shape with end regions (epiphysis) and a middle region (diaphysis). The metaphysis is the region between it and the epiphysis is the epiphyseal disk. When one bone comes in to contact with another at epiphysis which is covered in with articular cartilage, movement is allowed. Friction is reduced and shocks are absorbed at moveable joints by this articular cartilage.

(Omninoggin. com, 2017)

Periosteum is made up of two layers of dense connective tissue and is what covers the bone. One layer is on the outside and contains fibroblasts and collagen fibres, the inner layer contains osteoprogneitor cells. In the middle of the diaphysis, there is a hollow area called the medullary cavity which has a perimeter covered with an endosteum and an inside filled with red and yellow marrow. Red marrow's job is to generate blood cells and yellow marrow stores fat. (Encyclopedia Britannica, 2017)

Spongy bone tissue consists of an irregular lattice work of lamellae and thin plates of bone called trabeculae. Red bone marrow fills the spaces between the trabeculae. Haversian systems are based in the diaphysis and a compact bones structure is based on this. Their function is to support, protect and resist stress. (Training. seer. cancer. gov, 2017)

### **Types of cells found in the long bone:**

#### **Osteoprogneitor cells**

- The divide by mitosis and develop into osteoblasts cells

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- They are in the inner layer of periosteum, endosteum, central and perforating canals.

### **Osteoblasts cells**

- Spread over the surface of the bones
- They form bone tissue by secreting a matrix of collagen and organic compounds

### **Osteocytes**

- Located in each lacuna throughout the bone tissue
- Maintain the bone matrix

### **Osteoclasts**

- Formed by a type of white blood cell
- Leave tiny unfilled spaces for the osteoblasts by destroying the bone matrix
- This causes the strength of the bone to be optimal, along with the repair and geometry.

### **The functions of the skeleton:**

#### **Support:**

The skeleton is the framework for the body and provides a point of attachment for skeletal muscles along with supporting softer tissues.

**Protection:**

Internal organs are protected by the skeleton. Some examples include the skull; the skull protects the brain. Another example is the ribcage which provides protection for the heart and lungs.

**Assisting in movement:**

Bones have skeletal muscles attached to them meaning that when they contract, bones move.

**Storage of minerals:**

The balance of minerals in the body is facilitated by the bones, when the blood requires them, the bone lets minerals into the bloodstream. Stored in blood tissue are minerals like calcium and phosphorus.

**Production of blood cells:**

In larger bones, the red marrow produces blood cells.

**Storage of chemical energy:**

When red bone marrow turns to yellow bone marrow as it ages, it becomes full of adipose and a few red blood cells. This process is an important chemical energy reserve.

**There are three main types of joints:****Fibrous joints:**

These are held together by a ligament and are immovable. Examples include where the teeth are held in their sockets and the tibiofibular and radioulnar joints.

**Cartilaginous joints:**

These are slightly moveable and occur when there is cartilage making up the connection between bones. Synchondroses are temporary cartilaginous joints that deplete with age such as the epiphyseal plates in long bones. Symphyses are permanent for example the pubic symphysis.

**Synovial joints:**

These are freely movable joints which have cartilage to pad the ends of bones, a synovial capsule that surrounds the entire joint and a synovial membrane that secretes a lubricating liquid. The six types of synovial joints can be seen in the table below:

**Bones:**

Articulating bones - the bones forming the joint (at least 2)

Periosteum - this is a white fibrous membrane that covers the outside surface of the bones. This only occurs where there is no articular cartilage.

Articular cartilage - this is a shiny elastic material that is made of a matrix of chondroitin sulphate, fine collagen fibrils and chondrocytes. It reduces friction and absorbs shock.

**In the Articular capsule:**

Fibrous capsule - this is made of a dense connective tissue and provides flexibility which allows movement at the joint and tensile strength which helps resist dislocation.

Intracapsular/extracapsular ligaments - Intracapsular ligaments are inside the articular capsule, for example the cruciate ligament in the knee joint.

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Extracapsular ligaments are outside the articular capsule, for example the fibular collateral ligament also in the knee joint.

**In the synovial cavity:**

Synovial membrane - this is made of loose layers of elastin fibres and adipose tissue. It secretes synovial fluid.

Synovial fluid - removes metabolic waste, supplies nutrients and provides the joint with lubrication.

Meniscal cartilage - this forms a pad which enables different shaped bones to come together and fit snugly. Also, helps absorb shock.

Bursae - this reduces mechanical friction, it can be present between muscle and bone, tendon and bone or ligament and bone. (Boundless, 2017)

When there is a disease of the spine that causes gradual loss of mobility in the joints between the vertebrae, it is called ankylosing spondylitis (AS). AS causes the vertebrae and the spinal joints in the lower spine to become inflamed and overtime this causes the spine to lose flexibility and fuse. (Nhs, 2017)

**Causes:**

The cause of AS is not yet known, however there does seem to be a link with developing AS and having a gene called HLA-B27 (human leukocyte antigen B27). 8 in 100 people in the general population have this gene, this makes them more vulnerable to developing AS, however not many do.

Environmental factors also contribute to the triggering of the condition, but it is not known what they are. (Mayo Clinic, 2017)

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**Symptoms:**

Due to AS being a systemic disease, symptoms are not limited to the joints. Eye inflammation, fatigue, fever, loss of appetite and in some case heart and lung disease can also occur. The most common symptoms that happen early in the disease, is pain and stiffness. This pain and stiffness continues for more than three months and is situated in the lower back, hips and buttocks. Spondylitis occurs around the sacroiliac joint at this point.

Bony fusion occurs when there is an overgrowth of bones which leads to bones joining abnormally. This can impair a person's ability to perform day to day tasks and can limit expansion of the chest. Ligaments and tendons also become inflamed which causes further pain and stiffness in areas like the Achilles tendon. (Mayo Clinic, 2017)

**Treatment:**

Treatment is available to relieve the symptoms of AS that can delay the spine fusing and stiffening but there is no cure.

Physiotherapy and regular exercise are highly recommended to slow down the disease. Non-steroidal anti-inflammatory drugs, paracetamol and codeine are the most popular and effective methods of pain relief for AS, but if they do not work anti TNF medication may be prescribed.

Anti TNF medication works by preventing the inflammatory effects of TNF as well as reducing inflammation in the joints caused by AS. Although effective, this medicine can have a negative effect on the immune system, so the decision to take it must be considered carefully.



Disease-modifying anti-rheumatic drugs can be taken, however they only help with inflammation in places other than the spine. Corticosteroids can be injected straight into the painful joint which gives and almost immediate pain relief. Side effects can include tissue wastage, a burst tendon and skin depigmentation.

In unusual cases, surgery may be an option. For example, a badly bent spine can be corrected, and a badly affected hip can be replaced. (Mayo Clinic, 2017)